Published in final edited form as:
J Am Acad Child Adolesc Psychiatry. 2014 May ; 53(5): 500–508. doi:10.1016/j.jaac.2013.12.021.

A Comparison of DSM-IV PDD and DSM-5 ASD Prevalence in an Epidemiologic Sample

Young Shin Kim, MD, MPH, PhD, **Eric Fombonne, MD**, **Yun-Joo Koh, PhD**, **Soo-Jeong Kim, MD**, **Keun-Ah Cheon, MD, PhD**, and **Bennett Leventhal, MD**

Dr. YS Kim is with the Child Study Center, Yale University, New Haven, CT, the Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY, and Yonsei University, Seoul, South Korea. Dr. Fombonne is with Oregon Health & Science University, Portland, OR. Dr. Koh is with the Korea Institute for Children's Social Development (“Rudolph”), Seoul, South Korea. Dr. S-J Kim is with the University of Washington, Seattle, WA. Dr. Cheon is with Yonsei University, Seoul, South Korea. Dr. Leventhal is with Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY, Yonsei University, Seoul, South Korea, and the University of Illinois, Chicago, IL.

Abstract

Objective—Changes in autism diagnostic criteria found in DSM5 may affect Autism Spectrum Disorder (ASD) prevalence, research findings, diagnostic processes and eligibility for clinical and other services. Utilizing our published, total-population Korean prevalence data, we compute DSM5 ASD and Social Communication Disorder (SCD) prevalence and compare them to DSMIV Pervasive Developmental Disorder (PDD) prevalence estimates. We also describe individuals previously diagnosed with DSMIV PDD when diagnoses change with DSM-5 criteria.

Method—The target population was all 7-12-year-old children in a South Korean community (N= 55,266), those in regular and special education schools and a disability registry. We utilized the Autism Spectrum Screening Questionnaire for systematic, multi-informant screening. Parents of screen-positive children were offered comprehensive assessments using standardized diagnostic procedures, including the Autism Diagnostic Interview-Revised and Autism Diagnostic Observation Schedule. Best estimate clinical diagnoses were made using DSMIV PDD and DSM5 ASD and SCD criteria.

Results—DSM5 ASD estimated prevalence is 2.20% (CI: 1.77-3.64). Combined DSM-5 ASD and SCD prevalence is virtually same as DSM-IV PDD prevalence (2.64%). Most children with Autistic Disorder (99%), Asperger Disorder (92%), and PDD NOS (63%) met DSM-5 ASD criteria, whereas 1%, 8% and 32%, respectively, met SCD criteria. All remaining children (2%)

Correspondence to Bennett Leventhal, Nathan Kline Institute for Psychiatric Research, 140 Old Orangeburg Road, Bldg 35, Orangeburg, NY 10962, P) 845-398-5502, F) 845-398-5510. bennett.leventhal@nki.rfmh.org.

Disclosure: Drs. YS Kim, Fombonne, Koh, S-J Kim, and Cheon report no biomedical financial interests or potential conflicts of interest. Dr. Leventhal has a consulting relationship with Janssen Pharmaceuticals that is specific to a single project that has no involvement in medication development or marketing.

had other psychopathology, principally Attention Deficit Hyperactivity Disorder and anxiety disorder.

Conclusion—Our findings suggest that most individuals with a prior DSMIV PDD meet DSM5 diagnostic criteria for ASD and SCD. PDD, ASD or SCD, extant diagnostic criteria identify a large, clinically meaningful group of individuals and families who require evidence-based services.

Keywords

ASD; SCD; DSMIV; DSM5; prevalence

INTRODUCTION

Studies of Autism Spectrum Disorders (ASD), conducted since 1985, have reported progressively higher prevalence, with estimates ranging from 0.07-2.64% [1-4]. Evidence suggests that most prevalence changes are attributable to a combination of: greater public awareness, better case ascertainment, lower age at diagnosis, diagnostic substitution, and changes in the diagnostic constructs and corresponding diagnostic criteria[3].

In the American Psychiatric Association's Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (DSM5) released in May 2013[5], changes include major alterations in criteria for developmental disorders, in particular, the DSMIV diagnostic criteria for Pervasive Developmental Disorder (PDD). These changes include: (1) Elimination of PDD and the five subtypes found in DSMIV; (2) Creation of a new, diagnostic category of ASD that is adapted to the individual's clinical presentation by inclusion of clinical specifiers and associated features; (3) Changing from the DSMIV PDD three domain criteria that included social reciprocity, communication and restricted and repetitive behaviors (RRB) to two DSM5 ASD domain criteria composed of social communication/interaction and RRB; (4) For DSM5, inclusion of sensory symptoms in the RRB component of diagnostic criteria; and, (5) For DSM5, changing the specification of the age of onset from “age three” to “early childhood.” Additionally, DSM 5 adds a new diagnostic category, “Social Communication Disorder (SCD).” SCD appears to include individuals who primarily have problems with the pragmatic aspects of social communication. According to DSM5, individuals with SCD have difficulties similar to ASD but these problems are solely restricted to the realm of social communication and do not include the DSM5 RRB criteria found in ASD[6].

Apparent differences between DSMIV PDD and DSM5 ASD criteria have led to debates, in both the scientific and lay communities, over whether these changes in diagnostic criteria will: materially affect ASD prevalence; alter the way individuals will be diagnosed with ASD; and, possibly, the eligibility of individuals for clinical and other services. Such debates are creating controversy amongst professionals, as well as confusion and anxiety for service providers, policy makers, and, most importantly, for patients and their families[7].

A number of investigators have attempted to address these important concerns by examining the reliability of the DSM5 ASD criteria (with its sensitivity and specificity) against DSMIV ASD criteria, primarily using clinic-based samples of individuals with ASD. Results of these

studies include sensitivity ranging from 46 to 96% and specificity from 53 to 100% (some were based on different versions of draft DSM5 criteria[8-13]). These studies appear to indicate that the DSM5 ASD criteria have reasonable sensitivity and specificity against DSMIV criteria. Nonetheless, there has been considerable debate, concern and speculation with respect to how many individuals with DSMIV PDD diagnoses will "lose diagnoses" with the advent of DSM5.

In order to answer these questions, we will directly compare DSMIV- and DSM 5-based ASD prevalence estimates while also determining which individuals, if any, classified as DSMIV PDD will not meet DSM5 ASD diagnostic criteria. We will use rigorous epidemiologic methods with a total population approach that includes both clinical and non-clinical populations of individuals with ASD, and systematic standardized screening and diagnostic assessment. Utilizing our total-population prevalence data from a recently completed and published study from a Korean cohort[4], we will:

1. Compute the DSM5-based ASD and SCD prevalence estimates among 7-12 years old children;
2. Compare DSM5 ASD and SCD prevalence estimates to DSMIV PDD prevalence estimates; and,
3. Describe demographic, ASD-related clinical and other associated characteristics of those individuals with DSMIV PDD diagnoses who were classified with ASD or SCD in DSM5 versus those individuals with DSMIV PDD who no longer fell into either of these DSM5 categories.

METHOD

The target population (N=55,266) included all children born from 1993-1999 (ages 7-12-years-old at screening) in a suburb of Seoul, South Korea. Total population screening was conducted with both the Parents' and Teachers' Autism Spectrum Screening Questionnaire (ASSQ), using the mandatory elementary education system and Disability Registry (DR). This total population approach allowed us to include and examine children with ASD who have used service systems, including health care and educational services (a clinical ASD population whom we labeled the "high probability group" or HPG), as well as those children with ASD who never received any services (a non-clinical sample with ASD whom we labeled the "general population sample" or GPS).

Children were considered to be screen-positive with a Teacher-ASSQ scores ≥ 10 and/or Parent-ASSQ scores in the top 2nd percentile. Additional screen positives came from a random sample of 50% of children in the 3rd percentile, and 33% of students in the 4th and 5th percentiles of Parent-ASSQ scores for children in regular education schools. All children in the DR and attending special education schools with diagnoses of ASD/Intellectual Disability (ID) were considered screen positive. Screen positive children were evaluated using standardized, diagnostic assessments: Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview-Revised (ADI-R), cognitive tests (Korean-Wechsler Intelligence Scale for Children-III and Leiter International Performance Scale-Revised), and Behavioral Assessment System for Children II-Parent Report Scale (BASC II-PRS)

validated in Korean children. Final best estimate clinical diagnoses were made using all systematically obtained, relevant data, based on DSMIV PDD diagnostic criteria. Each diagnostic team included one board-certified, Korean child psychiatrist, trained both in Korea and the US, plus a second board-certified child psychiatrist or child psychologist (Team 1: YSK/KAC; Team 2: YJK/SJK). Disagreements were resolved by reaching consensus between diagnosing clinicians. There was 98% agreement among Korean diagnosticians and 100% agreement among North American senior investigators (BLL/EF). The 2% initially discordant diagnoses were resolved in discussions amongst all investigators. Detailed case identification processes, validity and reliability of best estimate diagnoses are described in our 2011 paper[4].

Using this identical study population, case identification, confirmative diagnosis, and statistical methods, we re-evaluated all of the screen positive individuals who completed confirmative diagnostic assessment from our original study in order to establish diagnoses for DSMIV PDD subtypes, DSM5 ASD and DSM5 SCD, and to compute DSM5-based ASD and SCD prevalence estimates. 60 out of 292 cases (21%) were randomly chosen to examine diagnostic reliability for DSM 5 ASD and SCD criteria, for which each Korean team reached consensus diagnoses on all cases.

In addition to the reassessment of diagnoses for all cases, we divided the children who were ASSQ screen positive and completed diagnostic assessment into three groups, according to the level of agreement between DSMIV PDD and DSM5 ASD diagnostic criteria:

1. Divergent (D) – those with a DSMIV PDD diagnosis who did not have a DSM5 ASD diagnosis; (DSMIV PDD[+]/DSM5 ASD[-]; discrepant cases of DSMIV PDD[-]/DSM5 ASD[+] were absent, therefore, not included in the analyses); Divergent cases were further divided into two groups according to the new diagnoses received, including D-SCD (those with final diagnoses of SCD with/without comorbid psychiatric disorders) and D-Other (those with final diagnoses of other psychiatric disorders).
2. ASD Convergent - those children who met both DSMIV PDD criteria and DSM5 ASD criteria (DSMIV PDD [+]/DSM5ASD[+]) ; and
3. No ASD Convergent - those who neither meet DSMIV PDD nor DSM5 ASD criteria after completion of full assessment (DSMIV PDD [-]/DSM5 ASD [-]).

DATA ANALYSES

The denominator used to compute ASD prevalence was the entire target population (N=55,266) to reflect variance arising from non-participants[4]. Prevalence estimates by sex and ASD subtypes in the total population, as well as in the HPG and GPS, were computed using the SAS 9.1 Proc Frequency procedure[4]. Several strategies were utilized to adjust for missing data from screen-positive non-participants. Detailed methods to adjust for missing data and compute prevalence estimates are described in our 2011 paper[4].

We used chi-square statistics and ANOVA tests with Scheffe post-hoc analyses to compare demographic, ASD-related clinical and other associated characteristics of these three groups. A detailed description of the participants is provided in our 2011 paper[4].

RESULTS

Of 55,266, 7-12 year-old children, 36,886 children attended 33 participating elementary schools (from total 43 schools) and/or were enrolled in a DR. Parents of 23,337 children returned ASSQs (63% response). Of the 1,214 sampled screen-positive students, 869 (72%) parents, consented to participate in the diagnostic stage (70% male), and 292 (34%) completed diagnostic assessment.

1. Prevalence Estimates of DSMIV PDD

Using DSMIV criteria, we previously reported an estimated PDD prevalence of 2.64% (95% Confidence Interval [CI] 1.91-3.37) in a total population. We also found that the estimated DSMIV PDD prevalence was 1.89% (1.43-2.36) in the GPS and, total population prevalence estimate of ASD drawn from the HPG was 0.75% (0.58-0.93), with a much higher proportion of children with ASD in the HPG. Total male and female DSMIV PDD prevalence were 3.74% (2.57-4.90) and 1.47% (0.60-2.37), respectively, indicating a sex ratio = 2.5:1. In addition, we further classified DSMIV PDD by subtypes, and computed prevalence estimates for Autistic Disorder, Asperger Disorder and PDD NOS which were 1.04% (0.79-1.30), 0.60% (0.33-0.87) and 1.00% (0.66-1.34), respectively (Table 1).

2. Prevalence Estimates of DSM5 ASD

The estimated total population prevalence of DSM5 ASD is 2.20% (1.77-2.64). This is clearly different from the DSMIV PDD estimated total population prevalence of 2.64%. However, examination of these data suggests that the entirety of this difference comes from those individuals found in the generally higher functioning, lower service utilization, GPS sample; that is, the GPS DSMIV PDD prevalence was 1.89% versus GPS DSM5 ASD prevalence of 1.46% [1.06-1.85]. Further, this conclusion is supported by analyses indicating that the estimated prevalence of DSM5 HPG ASD, 0.75% (0.58-0.93), is virtually identical to the DSMIV PDD prevalence in that same HPG population: 0.75% (0.57-0.92).

3. Changes from DSMIV PDD Diagnoses When DSM5 ASD Criteria Are Applied

This can be further divided into three important questions:

a. What happens to the children with DSMIV Autistic Disorder (n=114) when DSM5 criteria are applied?

99% (n=112) have DSM5 ASD

1% (n=2) have SCD.

b. What happens to the children with DSMIV Asperger Disorder (n=34) when DSM5 criteria are applied?

91% (n=31) have DSM5 ASD

6% (n=2) have SCD

3% (n=1) have another psychiatric disorder.

c. Lastly, what happens to the children with DSMIV PDD NOS (n=58) when DSM5 criteria are applied?

71% (n=41) have DSM5 ASD

22% (n=13) have SCD

7% (n=4) have other, non-ASD or SCD disorders

DSM5 Male and female ASD prevalence estimates are 3.16% (2.47-3.85) and 1.17% (0.62-1.72), respectively, indicating a sex ratio = 2.7:1

4. Prevalence Estimates of SCD

We computed the estimated prevalence for SCD as 0.49% (0.21-0.77). SCD cases were identified only in the GPS (0.49%); that is, there were no SCD cases coming from the HPG group. Indeed, the largest proportion of children with DSM5 SCD is from those previously diagnosed with DSMIV PDD NOS (0.32% [0.09-0.54]); very few of these children had been previously diagnosed with DSMIV Asperger Disorder (0.05% [9.00-0.13]). Further, male and female prevalence estimates for SCD are 0.56% (0.17-0.95) and 0.42% (0.02-0.81), respectively, with a sex ratio of 1.3:1.

Since DSM5 ASD and SCD together seem to almost completely overlap with DSMIV PDD, we attempted to examine how many children actually met criteria for a disorder characterized by clinically significant difficulties with social reciprocity. To do this, we combined the data for DSM5 ASD and SCD to calculate the combined prevalence estimate. Using this strategy, it appears that the prevalence estimate for the DSMIV PDD is almost identical to that of the combined DSM5 ASD + SCD (2.7%) for every category, including the total population, as well as the GPS, HPG, ASD subtypes, and sex (Table 1).

5. Characteristics of Convergent/Divergent Cases of DSMIV PDD and DSM5 ASD Diagnoses

Finally, we examined the characteristics of those children whose diagnoses found convergence between DSMIV and DSM5 and those whose diagnoses were divergent. Of 292 confirmative diagnostic assessment completers, 270 (92%) had convergent diagnoses by DSMIV PDD and DSM5 ASD criteria. That is, of these 292 screen positive children, 63% (N=184) eventually had both DSMIV PDD and DSM5 ASD thus indicating convergence between DSMIV and DSM5; another 29% (N=86) did not have either a final DSMIV PDD or DSM5 ASD diagnosis meaning that they were also convergent but, in this instance, for no diagnosis.

However, there were 22 cases (8%) for which the DSMIV PDD and DSM5 ASD diagnoses were divergent; that is the DSMIV PDD and the DSM5 ASD diagnoses did not overlap. Based on this, one can conclude that 92% of individuals received similar diagnoses when both DSMIV and DSM5 criteria were applied. For the divergent cases, even though the PDD/ASD diagnoses did not overlap, all children still had a diagnosis of some form of

developmental psychopathology. Of these 22 divergent cases, 17 (77%) moved from Autistic Disorder (2), Asperger (2) and PDDNOS (13) to DSM5 SCD. In fact, all of the divergent DSMIV Autistic Disorder cases moved to SCD, as did most of the Asperger and PDD NOS cases. Ultimately, there were 5 cases that had a DSMIV PDD diagnosis but did not meet criteria for either DSM5 ASD or SCD. One was a DSMIV Asperger case who met criteria for Attention Deficit Hyperactivity Disorder (ADHD), as did one DSMIV PDDNOS case. All of the remaining divergent PDD NOS cases (N=3) met criteria for Anxiety Disorder. There were no age differences between the three groups however, more boys were present in the ASD convergent group, compared to the divergent group and the screen positive children who ultimately were in the “no ASD” (nASD) convergent groups (Table 2).

Significant differences in several aspects of ASD-related clinical characteristics emerged between the three groups (Table 3):

- ASSQ mean scores differed only between the no ASD convergent and the ASD convergent groups, with significantly higher scores in the ASD convergent group.

- SRS total and subscale scores, except the motivation subscale, in the ASD convergent group were significantly higher than those in the remaining two groups.

- When ADI-R and ADOS algorithm scores were examined, social reciprocity differed from each other on both the ADOS and ADI-R with higher levels of impairment in the ASD convergent group followed by the ASD divergent group and, then the no ASD convergent group.

- In contrast, the ADI-R communication scores were significantly higher only in the ASD convergent group when compared to the other two groups.

- ADOS communication scores differed in all three groups, with the most impairment in the ASD convergent group followed by the ASD divergent group and, then the no ASD convergent group.

- Additionally, stereotypy scores were significantly higher only in the ASD convergent group when compared to the other two groups, using both the ADOS and ADI-R.

- Onset of symptoms differed among the three groups, with the earliest onset occurring in the ASD convergent group, followed by divergent group and the no ASD convergent group.

- Differences in imagination on the ADOS were observed only between the ASD convergent and no ASD convergent groups.

Table 4 summarizes the BASC II-PRS mean T-scores of nine clinical subscales, externalizing and internalizing subscales and five adaptive composite scores in three groups. Of the clinical subscales, the anxiety score for the divergent group was significantly higher compared to ASD convergent group, however, there were no differences between the remaining groups. The withdrawal score was significantly higher in the ASD convergent group when compared to the no ASD convergent group, however, no differences were noted between the remaining groups. Likewise, on the BASC adaptive scales, social skills,

leadership and communication scores were significantly lower in the ASD convergent group when compared to the no ASD convergent group.

Amongst the 17 discordant cases that moved from DSMIV PDD to SCD, the reason appears to be primarily related to a relatively low level of RRBs. For the 5 discordant cases that had other forms of psychopathology, based on maternal reports, they all had social and behavioral disruptions that appear to be associated with ADHD or Anxiety Disorder (Table 3 and 4).

DISCUSSION

Findings from this study show that the new DSM5 ASD criteria yield changes in estimated prevalence previously established using the DSMIV PDD criteria. These changes include an approximate 17% decrease in the ASD prevalence from the prior DSMIV PDD prevalence estimate of 2.64% to a DSM5 ASD prevalence of 2.20%. These findings are not surprising. When one examines the new DSM5 criteria, it can be expected that some individuals without relatively high levels of the designated “core” ASD symptoms (social reciprocity and RRB) will move to one of two categories: no diagnosis or SCD. Further, it might have been reasonable to expect that those at greatest risk for such shifting are those individuals primarily with significant language deficits, high overall levels of functioning, low levels to no RRB, and who barely meet DSMIV PDD NOS criteria.

In fact, the DSM5 ASD criteria appear to offer meaningful clarifications relative to the previous diagnostic criteria because almost all individuals with DSMIV Autistic Disorder (98%) and Asperger Disorder (92%) meet DSM5 ASD diagnostic criteria. Most individuals with a DSMIV PDD NOS diagnosis have DSM5 ASD (71%) but a significant number (~29%) change. Such diagnostic changes occur exclusively amongst those individuals with a PDD NOS diagnosis who were identified among the GPS, a group that is characterized with milder ASD symptoms, average intelligence and less functional impairment[4]. Additionally, these changes occurred evenly between boys and girls.

When reviewing profiles of the 22 cases with diagnostic shifts, we found that even though divergent on the basis DSMIV PDD and DSM5ASD diagnoses, all of these cases still had a diagnosis of some form of developmental psychopathology. In fact, all of the divergent DSMIV Autistic Disorder cases moved to SCD, as did most of the Asperger Disorder and PDD NOS cases (76%).

Amongst the 17 divergent cases that moved from DSMIV PDD to SCD, the reason was primarily related to a relatively low level of RRBs, as seen in the ADOS and ADI-R stereotypy scores (Table 3). The remaining 5 divergent cases had other forms psychopathology, and also had lower SRS scores, higher BASC anxiety scores and higher ADOS scores for overactivity and anxiety codes. Otherwise, they appeared similar to the other divergent cases with respect to demographics, cognitive level, ADOS and ADI-R algorithm scores, and parental ASSQ responses (data not shown). This suggests that for children who no longer meet criteria for ASD or SCD, their social and behavioral

disruptions are likely associated with ADHD or Anxiety Disorder, however the sample size is too small for further meaningful statistical analyses.

We report that the estimated prevalence for SCD = 0.49% in this community ascertained population of school-aged children. While most SCD cases came from previous DSMIV PDD NOS cases, we identified 3 new SCD cases (2 girls) who did not have a prior PDD diagnosis. All of these children have significant difficulties in communication accompanied by a moderate lack of social reciprocity, based on both parental survey and direct interview; in addition, they all have modest difficulties in communication, as well as mild social reciprocity problems, based on the clinical interviews with the children.

In the final analysis, the divergence rate between DSMIV PDD and DSM5 ASD in the 292 screen positive assessment completers is a modest but important 8%. Indeed, if one considers DSM5 ASD and SCD to be in the same domain as DSM PDD, then the divergence rate drops to a remarkable 2%. It appears that when diagnostic category reassignment occurs, it is the result of two principal reasons: For those cases moving to SCD, it is due to relatively low levels of RRBs, whereas for those ending up with other psychiatric diagnoses, it is that the symptoms of those disorders marginally interfere with structured, social behavior. Most importantly, irrespective of the final diagnosis, all patients with a DSMIV PDD diagnosis still had significant psychopathology that merited follow-up and treatment.

This study provides comprehensive prevalence estimates by applying validated, reliable, gold-standard screening procedures and diagnostic methods in total population sample.

Limitations include that the SCD screening was conducted using the ASSQ, a screening questionnaire designed for ASD. Since the sensitivity and specificity of the ASSQ for SCD is unknown, SCD prevalence might have been underestimated in this study. Other limitations are stemming from missing data for non-participants and the relatively small proportion of children in the total sample who received a full diagnostic assessment. However, these are ubiquitous problems that are seen in similar epidemiological studies[14]. Various model building analyses, previously reported, indicated that error introduced by “missingness” is minimal[4], but we do report ASD and SCD prevalence estimates with due caution about the risks of over- and underestimation.

In summary, our findings suggest that most individuals with a prior DSMIV diagnosis of PDD move to the DSM5 categories of ASD or SCD. In fact, fewer than 2% of DSMIV PDD individuals have a DSM5 diagnosis other than ASD or SCD. Indeed, the combined prevalence of DSM 5 ASD + SCD is virtually identical to that of the DSMIV PDD for every category. These data provide essentially no support for the concerns that individuals affected with DSMIV PDD will “lose a diagnosis” with the advent of DSM5. When ASD and SCD are combined, then virtually everyone with a DSMIV PDD remains on the “new spectrum.” Since, until proven otherwise, the treatments for ASD and SCD remain the same or similar, it is important for children moving to SCD (and their families), to continue receiving the interventions they received with the DSMIV PDD diagnosis. And, for those falling out of the DSM5 ASD/SCD group, they appear to have other significant and impairing disorders that are also important and certainly deserve the care and attention appropriate for those

conditions; clinicians should promptly point these children in the right directions, even if ASD is not that direction. Finally, there is a need to follow up the DSMIV- DSM 5 divergent children to understand the natural course and outcomes of their conditions and how they are related or unrelated to ASD. But, in the final analysis, whether the label is PDD, ASD or SCD, extant diagnostic criteria are helpful in identifying a relatively large, clinically meaningful group of individuals and families who deserve comprehensive evaluations and evidence-based treatments, as early as possible.

Clinical Guidance

There has been concern that DSM-5 Autism Spectrum Disorder, including the end of the Autism, Asperger and PDD diagnoses, will impact prevalence along with eligibility for services and force alterations of practice guidelines. Hopefully allaying fears that DSM-5 creates major diagnostic changes for patients, this study found that DSM-IV PDD and DSM-5 ASD prevalence are quite similar. Additionally, the present study indicates that more than 90% individuals with a DSM-IV PDD diagnosis will have a DSM-5 ASD or SCD diagnosis. Further, those who no longer meet ASD criteria came from DSM-IV PDD-NOS and still have significant developmental psychopathology. For the practicing clinician, as well as patients and their families, this study should provide reassurance that there can be a smooth transition from DSM-IV to DSM-5 criteria that offer more clarity in the ASD diagnosis while adding the new but related disorder, SCD, as part of a continuum of neurodevelopmental disorders.

Acknowledgments

This research was funded by an Autism Speaks Pilot Research Grant and a Supplement Grant (7996), a Brain Research Foundation Research Grant, Simons Foundation Autism Research Initiative Pilot Grant (137032 M134793), NIMH Career Awards (5K01MH079317-02 [YSK] and K23MH082883 [SJK]) and NIEHS R01 Award (R01 ES021462-01). Additional funding was provided by the Jean Young and Walden W. Shaw Foundation, the Daniel X and Mary Freedman Foundation, and Dukyoung Foundation.

We are grateful to all of the schools and families participated in the study. We thank to Eugene Laska, PhD, with the Nathan S. Kline Institute for Psychiatric Research, for his statistical assistance.

REFERENCES

1. Baird G, Simonoff E, Pickles A, et al. Prevalence of disorders of the autism spectrum in a population cohort of children in South Thames: the Special Needs and Autism Project (SNAP). Lancet. Jul 15; 2006 368(9531):210–215. [PubMed: 16844490]
2. Fombonne E. The epidemiology of autism: a review. Psychol Med. Jul; 1999 29(4):769–786. [PubMed: 10473304]
3. Fombonne E. Epidemiology of pervasive developmental disorders. Pediatr Res. Jun; 2009 65(6): 591–598. [PubMed: 19218885]
4. Kim YS, Leventhal BL, Koh YJ, et al. Prevalence of autism spectrum disorders in a total population sample. Am J Psychiatry. Sep; 2011 168(9):904–912. [PubMed: 21558103]
5. APA. DSM5. American Psychiatric Association; DC: 2013.
6. APA. A05 Social Communication Disorder. 2013
7. Carey B. New Definition of Autism Will Exclude Many, Study Suggests. The New York Times. Jan.2012 19:2012.

8. Frazier TW, Youngstrom EA, Speer L, et al. Validation of proposed DSM-5 criteria for autism spectrum disorder. J Am Acad Child Adolesc Psychiatry. Jan; 2012 51(1):28–40. e23. [PubMed: 22176937]

9. Gibbs V, Aldridge F, Chandler F, Witzlsperger E, Smith K. Brief report: an exploratory study comparing diagnostic outcomes for autism spectrum disorders under DSM-IV-TR with the proposed DSM-5 revision. J Autism Dev Disord. Aug; 2012 42(8):1750–1756. [PubMed: 22677932]

10. Huerta M, Bishop SL, Duncan A, Hus V, Lord C. Application of DSM-5 criteria for autism spectrum disorder to three samples of children with DSM-IV diagnoses of pervasive developmental disorders. Am J Psychiatry. Oct; 2012 169(10):1056–1064. [PubMed: 23032385]

11. Mattila ML, Kielinen M, Linna SL, et al. Autism spectrum disorders according to DSM-IV-TR and comparison with DSM-5 draft criteria: an epidemiological study. J Am Acad Child Adolesc Psychiatry. Jun; 2011 50(6):583–592. e511. [PubMed: 21621142]

12. McPartland JC, Reichow B, Volkmar FR. Sensitivity and specificity of proposed DSM-5 diagnostic criteria for autism spectrum disorder. J Am Acad Child Adolesc Psychiatry. Apr; 2012 51(4):368–383. [PubMed: 22449643]

13. Taheri A, Perry A. Exploring the proposed DSM-5 criteria in a clinical sample. J Autism Dev Disord. Sep; 2012 42(9):1810–1817. [PubMed: 22806000]

14. Kelsey, JL.; Whittemore, AS.; Evans, AL.; Thompson, WD. Methods in observational epidemiology. Oxford University Press; Oxford, NY: 1996.

Table 1

Prevalence Estimates[a]: DSM-IV Pervasive Developmental Disorder (PDD), DSM-5 Autism Spectrum Disorder (ASD) and DSM-5 Social Communication Disorder (SCD)

	DSMIV PDD % (95% CI)	DSM5 ASD % (95% CI)	DSM5 SCD % (95% CI)	DSM5 ASD+SCD % (95% CI)
Population				
Total	2.64 (1.91-3.37)	2.20 (1.77-2.64)	0.49 (0.21-0.77)	2.70 (2.18-3.21)
GPS	1.89 (1.43-2.36)	1.46 (1.06-1.85)	0.49 (0.21-0.77)	1.95 (1.46-2.43)
HPG	0.75 (0.58-0.93)	0.75 (0.57-0.92)	0.00	0.75 (0.57-0.92)
DSMIV PDD Subtypes				
Autistic Disorder	1.04 (0.79-1.30)	1.03 (0.78-1.29)	0.01 (0.00-0.03)	1.04 (0.79-1.30)
Asperger	0.60 (0.33-0.87)	0.55 (0.29-0.80)	0.05 (0.00-0.13)	0.59 (0.33-0.86)
PDD-NOS	1.00 (0.66-1.34)	0.63 (0.38-0.87)	0.32 (0.09-0.54)	0.94 (0.61-1.28)
Sex				
Male	3.74 (2.57-4.90)	3.16 (2.47-3.85)	0.56 (0.17-0.95)	3.71 (2.92-4.51)
Female	1.47 (0.60-2.37)	1.17 (0.62-1.72)	0.42 (0.02-0.81)	1.58 (0.90-2.26)

Note: GPS=General Population Sample; HPG=High Probability Group; NOS = not otherwise specified

[a]From a representative, total population of Korean school-aged children

Table 2

Demographic Characteristics of DSMIV Pervasive Developmental Disorder (PDD) – DSM5 Autism Spectrum Disorder (ASD) Convergent (C)/Divergent (D) Cases (n=292)

	Divergent Group	Convergent Group		
	DIV[a] (n=22)	**C-nASD[b] (n=86)**	**C-ASD[c] (n=184)**	**p**
Other Diagnoses (Number (%))				
SCD	14 (64%)	2 (2%)	0 (0%)	
SCD and Other Psychiatric	3 (14%)	1 (1%)	0 (0%)	
Disorders	5 (22%)	54 (63%)	39(21%)	
Other Psychiatric Disorders	0 (0%)	29 (34%)	145 (79%)	
No Diagnoses				
Sex (Number (%))[e]				
Male	14 (64%)	54 (63%)	145 (79%)	
Female	8 (36%)	**32 (37%)[c]**	**39(21%)[b]**	**0.013**
Age in years (M±SD)[f]	10.6±1.7	10.1±1.8	10.1±1.7	0.494

Note: C-ASD=Convergent for ASD (PDD[+]/ASD[+]); C-nASD=Convergent for no ASD (PDD[−]/ASD[−]); DIV=Divergent for DSMIV PDD and DSM5 ASD (PDD[+]/ASD[−]); SCD=social communication disorder.

[a] Significant group differences from statistical tests.

[b] Significant group differences from statistical tests.

[c] Significant group differences from statistical tests.

[e] chi-square test (2df) was used to examine sex differences.

[f] Analysis of variance (ANOVA) test with Scheffé post-hoc analyses was used to examine age differences between DIS, A-nASD and A-ASD groups.

J Am Acad Child Adolesc Psychiatry. Author manuscript; available in PMC 2015 May 01.

Table 3

Autism Spectrum Disorder (ASD)–Related Clinical Characteristics of DSMIV Pervasive Developmental Disorder (PDD)-DSM5 ASD Convergent (C)/ Divergent (D) Cases (n=292)

	Convergent Group (N=274)		**Divergent Group (N=22)**	
	C-nASD[a] (n=86)	**C-ASD[b] (n=188)**	**D-SCD[c] (n=17)**	**D-Other[d] (n=5)**
Intellectual Deficit***	**6 (7%)**	**58 (32%)**	**2 (11.8%)**	**0 (0.0%)**
Performance IQ (M±SD)***	**99±18[b]**	**86±27[a]**	100±17	97±15
ASSQ Parents (M, (min, max))**	**20 (2, 46)[b]**	**27 (0, 54)[a]**	21 (14, 28)	20 (6, 33)
ADI-R Algorithm Scores (M±SD)				
Social Reciprocity***	**5.2±4.0[b,c]**	**17.8±7.5[a,c]**	**12.3±6.5[a,b]**	10.0±7.0
Communication***	**6.3±3.7[b]**	**13.8±4.9[a,c,§]**	**9.2±3.8[b]**	**8.0±4.7[b]**
Stereotypies***	**2.0±1.5[b]**	**4.8±2.5[a,c]**	**2.1±2.3[b]**	2.2±0.8
Onset<36months[d]***	**30 (35.3%)**	**154 (84.6%)**	**4 (76.5%)**	**1 (40.4%)**
ADOS Algorithm Scores (M±SD)				
Social Reciprocity***	**2.8±2.5[b,c,d]**	**8.7±2.8[a]**	**7.1±3.0[a]**	**6.6±1.5[a]**
Communication***	**1.5±1.2[b,c]**	**4.1±2.1[a]**	**3.0±2.0[a]**	2.8±1.6
Stereotypies***	**0.7±0.8[b]**	**1.9±1.6[a,c]**	**0.7±0.9[b]**	0.2±0.4
Imagination***	**0.5±0.6[b]**	**1.3±1.0[a]**	0.7±0.8	1.0±0.7

Note: ASSQ= autism spectrum screening questionnaire, ADI-R= autism diagnostic interview-revised, ADOS= autism diagnostic observation schedule, C-ASD= Convergent for ASD (PDD[+]/ASD[+]), C-nASD= Convergent for no ASD (PDD[−]/ASD[−]), D-social communication disorder (SCD) = Divergent for DSMIV PDD and DSM5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM5 SCD Diagnosis, D-Other= Divergent for DSMIV PDD and DSM5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM5 Other Psychiatric Disorders.

All other statistical tests were performed with analysis of variance (ANOVA) with Scheffé post-hoc analyses to examine differences in ASD-related clinical characteristics between C-nASD, C-ASD, D-SCD and D-Other groups.

[a] Significant group differences from statistical tests.

[b] Significant group differences from statistical tests.

[c] Significant group differences from statistical tests.

*** p<0.001

[d] chi-square test (2df) was used.

Table 4

Characteristics of Other Clinical Features in DSMIV Pervasive Developmental Disorder (PDD) - DSM5 Autism Spectrum Disorder (ASD) Convergent (C)/Divergent (D) Cases (n=292)[§]

	Convergent Group (n=134)		Divergent Group (n=8)	
	C-nASD[a] (n=49)	C-ASD[b] (n=85)	D-SCD[c] (n=7)	D-Other[d] (n=1)
BASC Clinical Scale (M±SD)				
Hyperactivity	67.3±13.8	63.4±15.9	59.7±15.4	84.7
Aggression	64.9±17.2	58.4±14.4	65.9±11.3	88.3
Conduct	62.8±15.4	58.4±14.1	60.1±12.6	75.4
Anxiety*	57.3±11.6	**55.7±12.3**[c]	**68.0±19.3**[b]	74.1
Depression	65.4±15.2	64.7±13.7	73.2±12.2	69.8
Somatization	60.4±15.0	54.3±14.7	55.0±10.3	66.5
Atypicality	71.2±17.8	75.4±20.0	69.5±12.2	65.7
Withdrawal**	**60.2±14.5**[b]	**70.2±16.7**[a]	69.1±22.2	67.3
Attention	62.7±11.2	62.0±11.0	58.1±13.5	62.1
Externalizing	67.1±15.6	61.5±15.0	63.5±10.5	87.3
Internalizing	62.6±13.8	59.3±13.5	68.2±11.2	73.6
BASC Adaptive Scale (M±SD)				
Adaptability	44.9±10.0	41.0±10.5	42.2±15.5	26.3
Social Skill*	**46.7±10.3**[b]	**41.5±10.8**[a]	47.4±10.9	39.9
Leadership***	**46.2±10.5**[b]	**39.7±10.3**[a]	42.6±7.3	46.2
Activity of Daily Living	38.1±10.6	38.2±11.9	44.1±10.7	44.5
Communication*	**42.4±11.7**[b]	**35.1±13.9**[a]	39.4±13.5	44.3
BASC Composite Scale (M±SD)				
Behavioral Symptom Index	67.1±14.9	68.3±14.4	68.2±7.1	77.9
Adaptive Skills*	**51.4±11.5**[b]	**45.6±11.8**[a]	51.5±11.9	48.1

Note: BASC= behavioral assessment scale for children; C-ASD= Convergent for ASD (PDD[+]/ASD[+]),C-nASD = Convergent for no ASD (PDD[−]/ASD[−]),D-Other: Divergent for DSMIV PDD and DSM5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM5 Other Psychiatric Disorders, D- social communication disorder (SCD)= Divergent for DSMIV PDD and DSM5 ASD (PDD[+]/ASD[−]) with final diagnosis of DSM5 SCD Diagnosis.

p-value:

J Am Acad Child Adolesc Psychiatry. Author manuscript; available in PMC 2015 May 01.

[§] ANOVA tests with Scheffé post-hoc analyses were performed to examine differences in associated clinical features between D-SCD, A-nASD and A-ASD groups (D-Other group was excluded from post-hoc analyses because it has only one group member).

[a] Significant group differences from statistical tests.

[b] Significant group differences from statistical tests.

[c] Significant group differences from statistical tests.

* $p<0.05$

** $p<0.005$